

Comparison of language and visual-motor developments between exclusively and non-exclusively breastfed infants through cognitive adaptive test/ clinical linguistic and auditory milestone scale

Lesmana Syahrir, Eddy Fadlyana, Sjarif Hidajat Effendi

Abstract

Background Provision of adequate nutrients is needed in the early year of life to support the most rapid growth and development period in infant's life. Moreover, warm and responsive parent-child interaction associated with breastfeeding is beneficial for optimal child development.

Objective The objective of this study was to compare the language and visual-motor developments between exclusively breast-fed and non-exclusively breast-fed infants.

Methods This historical cohort study was performed from May to June 2009. Study subjects consisted of 6-month-old infants lived in *Puskesmas* Garuda operational area. Language and visual-motor development were measured by cognitive adaptive test/ clinical linguistic & auditory milestone scale (CAT/CLAMS). The differences of CAT/CLAMS scores between groups were analyzed with Mann-Whitney test.

Results There were 39 exclusively breastfed and 39 non-exclusively breastfed infants enrolled in this study. No significant differences were found between the two groups concerning the subject or their parents characteristics. Mean CAT/CLAMS score of the exclusively breastfed infants was 8.34 points higher than that of the non-exclusively breastfed infants ($P=0.002$). Similar outcomes were found in language and visual-motor scales which were higher in the exclusively breastfed infants with the differences of 9.82 points ($P=0.001$) and 6.85 points ($P=0.039$), respectively.

Conclusion Exclusively breastfed infants has higher language and visual-motor developmental quotient score than non-exclusively breastfed infants. [Paediatr Indones. 2009;49:337-41].

Keywords: exclusive breastfeeding, development, language, visual-motor, CAT/CLAMS

Child development is influenced by genetic and environmental factors. Environmental factors, such as adequate nutrition and parents' ability to create a good and stimulating environment, have a strong positive influence on the child's development.¹ Human milk is species-specific, and all substitute feeding preparations differ markedly from it, making human milk uniquely superior for infant feeding. Exclusive breastfeeding is the reference model against which all alternative feeding methods must be measured with regard to growth, health, development, and all other short- and long-term outcomes.²

Children's development can be measured through social, physical, and cognitive developmental milestones. Speech and language development is a useful indicator of a child's overall development and is related to school success.^{3,4} Identification of infants with developmental delay or related problems may lead to intervention services and family assistance at a young age, when chances for improvement are best.⁵

From the Department of Child Health, Medical School, Padjadjaran University, Hasan Sadikin General Hospital, Bandung, Indonesia.

Reprint request to: Lesmana Syahrir, MD, Department of Child Health, Medical School, Padjadjaran Univeristy, Hasan Sadikin General Hospital, Jl. Pasteur no. 38, Bandung 41061, Indonesia. Tel/ Fax. +62-22-2035957. E-mail: lesmanasyahrir@gmail.com.

The goal of this study was to compare language and visual-motor developments between 6-month-old exclusively breastfed and non-exclusively breastfed infants through cognitive adaptive test/clinical linguistic & auditory milestone scale (CAT/CLAMS).

Methods

This study was carried out in *Puskemas Garuda Bandung* from May to June 2009. The study groups comprised 39 exclusively breast-fed and 39 non-exclusively breastfed infants. Inclusion criteria were healthy infants aged 6 months old, singleton, full term, spontaneously delivered, cried immediately after delivery, birth weight of ≥ 2500 g, and good nutritional status. Infants with congenital malformations or with delivery complications were excluded. Written informed consents were obtained from parents. Ethical approval for this study was granted by The Health Research Ethics Committee of Medical School of Padjadjaran University.

The CAT/CLAMS comprising 100-item scale was chosen for due to its easiness of administration and minimal needs for special equipment, as well as clear interpretation.⁶ It was administered in a standardized fashion with an average of five items per age level. Information about a child's development was obtained by both parental report and direct observation of the child.

CAT consisted of visual-motor problem-solving items, which were performed directly toward the child. CLAMS items consisted of language acquisition. A score was derived for CAT and CLAMS separately. CAT/CLAMS score was the numerical average of the two, converted to a developmental quotient (DQ) by dividing total score by the chronological age in months and multiplying by 100.^{7,8}

Kappa coefficient, which measures agreement beyond that expected by chance, was performed before this study to evaluate interobserver reliability of CAT/CLAMS between investigator and developmental pediatrician experienced in pediatric developmental assessment.

Subject and parents characteristics were examined using chi-square analysis for categorical variables. For numerical variables with normal distribution, t test was used to compare values. For

variables without normal distribution the Mann-Whitney test was used. All statistical significances were tested at alpha level of 0.05. SPSS 13.0 for Windows (SPSS, Inc., Chicago, IL) was used for statistical analyses.

Results

At 6 months of age, the mean weight, length, and head circumference of the exclusively breastfed infants were higher than the non-exclusively breastfed infants, however those differences were not statistically significant (**Table 1**).

There were no significant differences between the exclusively breastfed and non-exclusively breastfed groups regarding parental education and occupation, family income, and number of siblings (**Table 2**).

Calculation of Kappa coefficient of CAT/CLAMS results between investigator and developmental pediatrician was ≥ 0.75 which suggested that there was a very good agreement between the two.

The mean CAT/CLAMS score (full-scale developmental quotient) of the non-exclusively breastfed infants was 106.96 (range 78.5 to 133). The mean CAT/CLAMS score of the exclusively breastfed infants was 115.30 (range 96 to 132), which was 8.34 points higher than that of the non-exclusively breastfed group ($P=0.002$) (**Table 3**).

Table 1. Characteristics of study subjects

Characteristics	Exclusively breastfed (n=39)	Non-exclusively breastfed (n=39)	P
Gender			
Male	19	21	0.651
Female	20	18	
Birth weight (g)			
Mean	3087.2	3029.5	0.602
Range	2500-4000	2,500-3,800	
Weight (kg)			
Mean	7.25	7.01	0.225
Range	6.2-9.0	6.0-8.5	
Length (cm)			
Mean	63.38	63.04	0.226
Range	60-66	60-65	
Head circumference (cm)			
Mean	42.36	41.90	0.069
Range	40.0-44.5	40.0-45.0	
Major caregiver by mother	39	35	0.115

Table 2. Characteristics of parents

Parent characteristics	Exclusively breastfed		Non-exclusively breastfed		P
	n	%	n	%	
Maternal education					
≤ Junior high school	26	67	25	64	0.812
> Junior high school	13	33	14	36	
Maternal occupation					
Unemployed	38	97	34	87	0.2
Employed	1	3	5	13	
Paternal education					
≤ Junior high school	23	59	15	39	0.07
> Junior high school	16	41	24	61	
Paternal occupation					
Unemployed	3	7	2	5	0.644
Employed	36	93	37	95	
Family income (Rp)					
<850,000	23	59	23	59	1.0
≥ 850,000	16	41	16	41	
Number of siblings (incl. subject)					
≤ 2	26	67	32	82	0.12
> 2	13	33	7	18	

Table 3. Language and visual-motor developmental quotient of exclusively breastfed and non-exclusively breast-fed infants

Score	Exclusively breast-fed (n=39)	Non-exclusively breast-fed (n=39)	P
CAT/CLAMS score			
Mean	115.30	106.96	0.002
Range	96-132	78.5-133	
Language scale (CLAMS score)			
Mean	121.23	111.41	0.001
Range	93-142	77-133	
Visual-motor scale (CAT score)			
Mean	109.36	102.51	0.039
Range	75-133	72-133	

Similar results were found in the CLAMS score (language scale) and CAT score (visual-motor scale) when they were analyzed separately. The mean CLAMS score of the exclusively breastfed infants (121.23; range 93 to 142) was 9.82 points higher than the non-exclusively breast-fed infants (111.41; range 77 to 133) (P=0.001). The mean CAT score of the exclusively breastfed infants (109.36; range 75 to 133) was 6.85 points higher than the non-exclusively breastfed infants (102.51; range 72 to 133) (P=0.039).

Discussion

The results of the present study revealed that infants who were breastfed exclusively had better CAT/

CLAMS performance than they who were not breastfed exclusively. Several studies have indicated that human milk-fed term and premature infants have improved visual and auditory functions compared to formula-fed infants. Amin et al⁹ showed that auditory-evoked responses mature faster in breastfed infants. Visual benefit has been attributed to docosahexaenoic acid, which is a component of phospholipids found in brain, retina, and red cell membranes.¹⁰⁻¹² Docosahexaenoic acid is present in human milk but not in bovine milk. This could explain how language and visual-motor performances were significantly better in the exclusively breastfed group.

Our results are consistent with several larger studies in various communities using a number of developmental tests, which has shown a positive association between breastfeeding and child development.¹³⁻¹⁷ Horwood and Fergusson¹⁸ in their analyses on data from a birth cohort of more than 1000 New Zealand children over the period from 8 to 18 years concluded that breastfeeding was associated with detectable increases in child cognitive ability and educational achievement. They found that children who were breastfed had mean test scores between 0.35 and 0.59 SD units, higher than children who were bottlefed. In 1999, a meta-analysis including 20 studies from 1966 to 1996 showed that breastfeeding was associated with significant higher scores on cognitive development tests.¹⁹ Adjusting for several confounders, the mean difference between breastfed

children and children who had been exclusively bottlefed was 3.16 points (95% CI 2.35 to 3.98).

The CAT/CLAMS is an instrument that assesses language and visual-motor problem solving development in infants and toddlers from 1 to 36 months of age.^{7,8} This instrument has been shown to correlate well with mental developmental index of Bayley scales of infant development, the gold standard of early developmental assessment instrument in normal,⁶ at risk,²⁰ and developmentally delayed populations.^{21,22} The CAT/CLAMS can be quickly and easily administered by pediatricians with varying levels of training.²³

Children in this study were randomly selected. There were no differences in subjects and parents characteristics. Moreover, the examiner did not know the status of infants' breastfeeding. Bias was therefore had been minimized in this study. There is a possibility that some infants who were classified as exclusively breastfed may actually were not entirely exclusive. An attempt had been made to reduce this inaccuracy by describing clearly to the parents on the definition of exclusive breastfeeding that there was no other drink, such as formulas, water, teas, honey, fruit juice, and no other food, such as bananas, papayas, biscuits, cereals, baby foods, or any other foods, except breast milk for at least 6 months of life.

In conclusion, CAT/CLAMS scores of exclusively breastfed infants are higher than non-exclusively breastfed infant. Language and visual-motor benefits of exclusive breastfeeding has appeared to infants as early as 6 months of age.

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